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Methods of Providing Communications Services

Inventors:

Randy Zimler

&

Lee G. Friedman

Bambi F. Walters

Scott P. Zimmerman

Walters & Zimmerman

P.O. Box 3822

Cary North Carolina 27519

(919) 387-6907

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TITLE OF THE INVENTION

Methods for Providing Communications Services

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BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] This invention generally relates to digital communications and, more particularly, to expanding bandwidth in communications systems using multiple physical mediums.

2. Description of the Related Art

[0003] Communications customers need more bandwidth. As more and more customers utilize advanced communications services including "video-on-demand" applications, more and more data must be transmitted along twisted cable pairs, coaxial cables, fiber optic lines, and/or whatever medium is available. This video-on-demand service can require upwards of 3 megabits per second of data with a standard television format, while a High-Definition Television (HDTV) format might require a minimum of 16 megabits per second of data. A Digital Subscriber Line, however, is generally limited to a download data rate of 1.5 megabits per second. Even with advanced video compression techniques, such as ITU H.264 (MPEG 4, Part 10), Digital Subscriber Lines, coaxial cables, and even some fiber optic installations cannot provide enough bandwidth to support these advanced broadband-intensive communications services, such as the

video-on-demand service. There is, accordingly, a need in the art for methods and systems of increasing the bandwidth capacity of physical mediums to support advanced broadband-intensive communications services.

BRIEF SUMMARY OF THE INVENTION

[0004] The aforementioned problems, and other problems, are reduced by a methods, systems, and products for bonding additional physical mediums to increase data rates. When a communications customer requests a broadband-intensive communications service (such as downloading movies or other high-bandwidth media content), this invention physically and logically bonds a second physical medium to provide additional bandwidth. This second physical medium is physically connected to the customer's premises, yet this second physical medium is also shared amongst other customer's premises. When the customer requires broadband-intensive communications services, this invention temporarily bonds the second physical medium to the customer's data session to provide additional bandwidth. When the customer no longer requires the additional bandwidth, the second physical medium reverts to its shared configuration, thus allowing another customer to receive additional bandwidth when required.

[0005] This invention discloses methods, systems, and products for providing communications services. One of the embodiments describes a method for providing communications services. Signals are transmitted to a destination via a first physical medium. Signals are also transmitted to the same destination via a second physical medium. This second physical medium is configured as a dedicated circuit or may be shared amongst multiple destinations. When the destination requires additional bandwidth, the second physical medium provides the additional bandwidth.

[0006] Another of the embodiments describes another method for providing communications services. Here, digital subscriber signals are transmitted to a destination via a first twisted pair. Digital subscriber signals are also transmitted to the destination via a second twisted pair. The

second twisted pair is configured as a dedicated circuit or may be shared amongst the destination and another destination. The second twisted pair provides additional bandwidth when required. The second twisted pair and the first twisted pair may be logically bonded to the destination, such that first twisted pair and the second twisted pair share the same session of information.

[0007] Still more of the embodiments describe yet another method for providing communications services. A request for communications services is received from a communications device. A first physical medium and a second physical medium are logically bonded to the communications device. The second physical medium is configured as a dedicated circuit or can also be dynamically shared amongst multiple communications devices to provide additional bandwidth when required. The communications services are then provided via the logically bonded first physical medium and the second physical medium.

[0008] Other embodiments of this invention describe a system for providing communications services. A Communications Module is stored in a memory device, and a processor communicates with the memory device. The Communications Module receives a request for communications services from a communications device. The Communications Module compares a bitrate of the requested communications services to the bandwidth of a first physical medium serving the communications device. If the bitrate of the requested communications services exceeds the available bandwidth of the first physical medium, then the Communications Module instructs a network device to logically bond a second physical medium to the communications device. The logically bonded second physical medium provides additional bandwidth to the communications device.

[0009] Other embodiments of this invention describe a computer program product. A computer-readable medium stores a Communications Module. The Communications Module receives a request for communications services from a communications device. The Communications Module compares a bitrate of the requested communications services to the bandwidth of a first physical medium serving the communications device. If the bitrate of the requested communications services exceeds the available bandwidth of the first physical

medium, then the Communications Module instructs a network device to logically bond a second physical medium to the communications device. The logically bonded second physical medium provides additional bandwidth to the communications device.

[0010] Other systems, methods, and/or computer program products according to embodiments will be or become apparent to one with skill in the art upon review of the following drawings and detailed description. It is intended that all such additional systems, methods, and/or computer program products be included within this description, be within the scope of the present invention, and be protected by the accompanying claims.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0011] These and other features, aspects, and advantages of the embodiments of the present invention are better understood when the following Detailed Description of the Invention is read with reference to the accompanying drawings, wherein:

FIG. 1 is a simplified schematic illustrating one or more embodiments of this invention;

FIG. 2 is a schematic applying the principles of this invention in a Digital Subscriber Line (DSL) environment, according to more embodiments of this invention;

FIG. 3 is detailed schematic showing *n* multiple physical media, according to still more embodiments of this invention;

FIG. 4 is a block diagram showing a Communications Module residing in a computer system, according to the embodiments of this invention;

FIG5. 5 is a flowchart illustrating a method of providing communications services, according to even more embodiments of this invention;

FIG. 6 is a flowchart illustrating another method of providing communications services, according to more embodiments of this invention; and

FIG. 7 is a flowchart illustrating yet another method of providing communications services, according to yet more embodiments of this invention.

DETAILED DESCRIPTION OF THE INVENTION

[0012] This invention now will be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. These embodiments are provided so that this disclosure will be thorough and complete and will fully convey the scope of the invention to those of ordinary skill in the art. Moreover, all statements herein reciting embodiments of the invention, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future (*i.e.*, any elements developed that perform the same function, regardless of structure).

[0013] Thus, for example, it will be appreciated by those of ordinary skill in the art that the diagrams, schematics, illustrations, and the like represent conceptual views or processes illustrating systems and methods embodying this invention. The functions of the various elements shown in the figures may be provided through the use of dedicated hardware as well as hardware capable of executing associated software. Similarly, any switches shown in the figures are conceptual only. Their function may be carried out through the operation of program logic, through dedicated logic, through the interaction of program control and dedicated logic, or even manually, the particular technique being selectable by the entity implementing this invention. Those of ordinary skill in the art further understand that the exemplary hardware, software, processes, methods, and/or operating systems described herein are for illustrative purposes and, thus, are not intended to be limited to any particular named manufacturer.

[0014] FIG. 1 is a simplified schematic illustrating this invention. The embodiments of this invention include a Communications Module 20. The Communications Module 20 comprises methods, systems, computer programs, and/or computer program products that help provide communications services to a client communications device 22. The Communications Module 20 operates within a computer 24. The computer 24 receives a request 26 for communications

services from the client communications device 22. When the client communications device 22 requires communications service, the term "communications service" means the client communications device 22 requests a data upload and/or a data download via a data/communications network. The term "data" includes electronic information, such as, for example, facsimile, electronic mail (e-mail), text, video, audio, and/or voice in a variety of formats, such as dual tone multi-frequency, digital, analog, and/or others. Additionally, the data may include: (1) executable programs, such as a software application, (2) an address, location, and/or other identifier of the storage location for the data, (3) integrated or otherwise combined files, and/or (4) profiles associated with configuration, authenticity, security, and others. The request 26 for communications services is received via a first physical medium 28 serving the client communications device 22. When the requested communications services exceeds the available bandwidth of the first physical medium 28, then the Communications Module 20 instructs a network device 30 to logically bond a second physical medium 32 to the client communications device 22. The logically bonded second physical medium 32 provides additional bandwidth to the client communications device 22.

[0015] As FIG. 1 shows, the second physical medium 32 is shared. That is, the second physical medium 32 is physically connected to the client communications device 22 and to multiple, other destinations. These other destinations may include another client communications device 34 in another customer's premises 36. The second physical medium 32 may also be shared amongst multiple destinations within an office building 38 and/or within multiple residential customers in a neighborhood 40. Even though the second physical medium 32 is shared amongst multiple destinations, the second physical medium 32 can be dynamically dedicated to a single destination when additional bandwidth is required. When the client communications device 22 requires communications services that exceed the available bandwidth of the first physical medium 28, then the shared second physical medium 32 may provide additional bandwidth. In the case where a third, fourth, or "*n*" number of circuits are required, additional physical media 32 can be physically and logically bonded to the client communications device 22. Data signals may then be transmitted to the client communications device 22 using the first physical medium 28, the second physical medium 32, and the "*n*" number of additional media. When the additional

bandwidth is no longer required, the additional media reverts to its shared configuration and awaits another destination that requires additional bandwidth. In general, the terms "second physical medium" and "additional media" represent any "*n*" number of physical and logical connections required to terminate on the client communications device 22 in order to provide adequate bandwidth for the desired service.

[0016] The second physical medium 32 is preferably bonded to the first physical medium 28. The terms "bond," "bonded," "bonding," and other similar terms means the first physical medium 28 and the second physical medium 32 share the same session of information. When the client communications device 22 requires communications services via the first physical medium 28, the communications services are provided during Point-to-Point Protocol (PPP) session of information. That is, the client communications device 22 is logically connected to the first physical medium 28. When the available bandwidth of the first physical medium 28 cannot provide the requested communications services, the second physical medium 32 shares that same session of information. The first physical medium 28 and the second physical medium 32 are physically connected to the client communications device 22 and they share a single logical connection. The Communications Module 20 recognizes that the second physical medium 32 is now associated with the client communications device 22. The second physical medium 32 is dynamically added in terms of the capabilities of a service at the point when the client communications device 22 requires additional bandwidth. The client communications device 22 is thus served via the first physical medium 28 and with the shared, bonded second physical medium 32.

[0017] The term "physical medium" implies a physical connection. Data signals are transmitted to/from the client communications device 22 via at least one physical connection. The first physical medium 28 and the second physical medium 32 may both be a twisted copper pair of wires, as is commonly found throughout many communications networks (such as the Public Switched Telephone Network). The first physical medium 28 and the second physical medium 32, however, may also include coaxial cable and/or fiber optic cable. The first physical medium 28 and second physical medium 32 may even include at least one of i) a combination of

a twisted pair and a coaxial cable, ii) a combination of a twisted pair and a fiber optic cable, and iii) a combination of a coaxial cable and a fiber optic cable.

[0018] The network device 30 bonds the second physical medium 32. When the available bandwidth of the first physical medium 28 is exceeded, the Communications Module 20 instructs the network device 30 to logically bond the second physical medium 32 to the client communications device 22. The logically bonded second physical medium 32 provides additional bandwidth to the client communications device 22. The network device 30 can be a computing device that can execute instructions from the Communications Module 20. Some examples of the network device 30 may include an internet server, a content server, a gateway, a switch, a multiplexer, a modem, or any other device that can logically bond additional bandwidth.

[0019] This invention is further illustrated by the following non-limiting example. FIG. 2 is a detailed schematic applying the principles of this invention in a Digital Subscriber Line (DSL) environment. As those of ordinary skill in the art understand, DSL uses twisted pair transmission lines to transmit high-bandwidth, high frequency signals. DSL is a transport medium for signals along a single twisted-wire pair. This twisted wire pair supports both Message Telecommunications Service (*e.g.*, Plain Old Telephone Service), full-duplex (simultaneous two-way), and simplex (from the network to a customer's installation) digital services. Because DSL is commonly available to residential customers and to business customers, this patent will not further discuss DSL technology. If, however, the reader desires more information on DSL technology, the reader is invited to consult AMERICAN NATIONAL STANDARDS INSTITUTE, *Network to Customer Installation Interfaces — Asymmetric Digital Subscriber Line (ADSL) Metallic Interface* (ANSI T1.413-1998) (1819 L Street NW, Washington, DC 20036, (202) 293-8020, www.ansi.org), and incorporated herein by reference in its entirety.

[0020] FIG. 2 shows a customer's premises 42. The customer's premises 42 are served by multiple physical media 44, such as a first twisted pair 46 and a second twisted pair 48. The multiple physical media 44 are shown connected to a residential gateway 50, such as a DSL

modem, cable modem, router, or other access device. The residential gateway 50 provides an access interface to one or more of the customer's client communications devices 22. The customer may have multiple client communications devices 22 communicating via a home network with the residential gateway 50. FIG. 2, for example, shows the multiple client communications devices 22 as a computer 52 and one or more digital television devices 54 (including a television set-top box (STB)). The client communications devices 22, of course, could also include other computer devices (such as a laptop, desktop, tablet, server, and other computer systems), a personal digital assistant (PDA), a Global Positioning System (GPS) device, an Internet Protocol (IP) phone, a pager, a cellular/satellite phone, a modem, or any computer/communications device utilizing a digital signal processor (DSP).

[0021] The customer's client communications devices 22 requests communications services via the first twisted pair 46. Assume, for example, that one of the digital television devices 54 requests a download of video data (*e.g.*, a video-on-demand service). A video-on-demand (VoD) request 56 is communicated via the first twisted pair 46 through a Digital Subscriber Line Access Multiplexer 58, through an asynchronous transfer mode (ATM) switch 60, through a broadband gateway 62, and into a primary ATM network 64. The video-on-demand request 56 routes along the ATM network 64 to the Communications Module 20 operating in the ATM network 64. FIG. 2 shows the Communications Module 20 operating in multiple computer devices within the ATM network 64, although those of ordinary skill in the art understand the Communications Module 20 may operate within a single computer device. The Communications Module 20 compares the bandwidth required to provide the requested video-on-demand service and the available bandwidth along the first twisted pair 46. The Communications Module 20 thus determines whether enough bandwidth is available to deliver the requested video over the first twisted pair 46 (*e.g.*, a single DSL connection).

[0022] The video-on-demand request 56 routes along the ATM network 64 to a content server 66. This content server 66 may store some, or all, of the requested video data. The content server 66 determines the bitrate of the requested video data (*e.g.*, 5 megabits per second of video data). The content server 66 then sends bitrate information 68 to a web server/service control

computer device 70. If the available bandwidth is inadequate for a Quality of Presentation objective, the Communications Module 20 instructs a radius cluster 72 to arrange adequate bandwidth. The radius cluster 72 observes the configuration of the first twisted pair 46 and the configuration of the second, shared twisted pair 74. The radius cluster 72 then instructs the Digital Subscriber Line Access Multiplexer (DSLAM) 58 to establish physical bonding with the second twisted pair 48. The radius cluster 72 also instructs the Digital Subscriber Line Access Multiplexer 58 to establish logical bonding of the Point-to-Point Protocol (PPP) session of information. The radius cluster 72 manages the logic on the broadband gateway 62, thus instructing the Digital Subscriber Line Access Multiplexer 58 to enable the bonding. Once the second twisted pair 48 is physically and logically bonded, the content server 66 may then transmit/deliver the requested video data content to the digital television device 54 via the Internet Protocol (IP) network 64. The physically and logically bonded second twisted pair 48 provides additional bandwidth to the digital television device 54. When the additional bandwidth is no longer required, the radius cluster 72 instructs the Digital Subscriber Line Access Multiplexer 58 to terminate the physical bonding and the logical bonding, thus reverting the second twisted pair 48 to its shared configuration.

[0023] FIG. 3 is another detailed schematic applying the principles of this invention in a Digital Subscriber Line (DSL) environment. FIG. 3 is very similar to FIG. 2, except here the customer's premises 42 are served by *n* multiple physical media 44. That is, the when the requested communications service exceeds the available bandwidth of a primary twisted pair (such as the first twisted pair 46), the Communications Module 20 instructs the radius cluster 72 to arrange additional bandwidth. The radius cluster 72 again observes the configuration of the primary twisted pair. Here, however, the radius cluster 72 may observe the configuration of *n* multiple shared twisted pairs 74, where *n* denotes any integer. The radius cluster 72 can instruct the Digital Subscriber Line Access Multiplexer 58 to dynamically establish physical and logical bonding with *n* multiple shared twisted pairs 74. These *n* multiple shared twisted pairs 74 provide *n* bonded PPP sessions to dynamically provide as much bandwidth as the customer might require. Once the additional bandwidth is no longer required, the radius cluster 72 reverts the *n* multiple shared twisted pairs 74 to their shared configuration.

[0024] FIG. 4 is a block diagram showing the Communications Module 20 residing in the computer system 24. The computer system 24 may be any computing device, and the computer system 24 may include the content server, the web server/service control computer device, and the radius cluster (shown, respectively, as reference numerals 66, 70, and 72 in FIGS. 2 and 3). The Communications Module 20 operates within a system memory device. The Communications Module 20, for example, is shown residing in a memory subsystem 76. The Communications Module 20, however, could also reside in flash memory 78 or peripheral storage device 80. The computer system 24 also has one or more central processors 82 executing an operating system. The operating system, as is well known, has a set of instructions that control the internal functions of the computer system 24. A system bus 84 communicates signals, such as data signals, control signals, and address signals, between the central processor 82 and a system controller 86 (typically called a "Northbridge"). The system controller 86 provides a bridging function between the one or more central processors 82, a graphics subsystem 88, the memory subsystem 76, and a PCI (Peripheral Controller Interface) bus 90. The PCI bus 90 is controlled by a Peripheral Bus Controller 92. The Peripheral Bus Controller 92 (typically called a "Southbridge") is an integrated circuit that serves as an input/output hub for various peripheral ports. These peripheral ports are shown including a keyboard port 94, a mouse port 96, a serial port 98 and/or a parallel port 100 for a video display unit, one or more external device ports 102, and networking ports 104 (such as SCSI or Ethernet). The Peripheral Bus Controller 92 also includes an audio subsystem 106. Those of ordinary skill in the art understand that the program, processes, methods, and systems described in this patent are not limited to any particular computer system or computer hardware.

[0025] Those of ordinary skill in the art also understand the central processor 82 is typically a microprocessor. Advanced Micro Devices, Inc., for example, manufactures a full line of ATHLON™ microprocessors (ATHLON™ is a trademark of Advanced Micro Devices, Inc., One AMD Place, P.O. Box 3453, Sunnyvale, California 94088-3453, 408.732.2400, 800.538.8450, www.amd.com). The Intel Corporation also manufactures a family of X86 and P86 microprocessors (Intel Corporation, 2200 Mission College Blvd., Santa Clara, California

95052-8119, 408.765.8080, www.intel.com). Other manufacturers also offer microprocessors. Such other manufacturers include Motorola, Inc. (1303 East Algonquin Road, P.O. Box A3309 Schaumburg, IL 60196, www.Motorola.com), International Business Machines Corp. (New Orchard Road, Armonk, NY 10504, (914) 499-1900, www.ibm.com), and Transmeta Corp. (3940 Freedom Circle, Santa Clara, CA 95054, www.transmeta.com). Those skilled in the art further understand that the program, processes, methods, and systems described in this patent are not limited to any particular manufacturer's central processor.

[0026] The preferred operating system is the UNIX® operating system (UNIX® is a registered trademark of the Open Source Group, www.opensource.org). Other UNIX-based operating systems, however, are also suitable, such as LINUX® or a RED HAT® LINUX-based system (LINUX® is a registered trademark of Linus Torvalds, and RED HAT® is a registered trademark of Red Hat, Inc., Research Triangle Park, North Carolina, 1-888-733-4281, www.redhat.com). Other operating systems, however, are also suitable. Such other operating systems would include a WINDOWS-based operating system (WINDOWS® is a registered trademark of Microsoft Corporation, One Microsoft Way, Redmond WA 98052-6399, 425.882.8080, www.Microsoft.com). and Mac® OS (Mac® is a registered trademark of Apple Computer, Inc., 1 Infinite Loop, Cupertino, CA 95014, 408.996.1010, www.apple.com). Those of ordinary skill in the art again understand that the program, processes, methods, and systems described in this patent are not limited to any particular operating system.

[0027] The system memory device (shown as memory subsystem 76, flash memory 108, or peripheral storage device 80) may also contain an application program. The application program cooperates with the operating system and with a video display unit (via the serial port 98 and/or the parallel port 100) to provide a Graphical User Interface (GUI). The Graphical User Interface typically includes a combination of signals communicated along the keyboard port 94 and the mouse port 96. The Graphical User Interface provides a convenient visual and/or audible interface with a user of the computer system 24.

[0028] The principles of this invention may be applied to other environments. When requested communications services exceed the available bandwidth of a primary first physical medium serving a customer's premises, and/or a client communications device, then this invention physically and logically bonds *n* multiple, additional physical mediums. The bonded *n* multiple, additional physical mediums provide additional bandwidth when necessary. Because the term "physical medium" implies a physical connection, the principles of this invention are not limited to Digital Subscriber Line environments. The principles of this invention may be applied to a generic physical infrastructure, such as a fiber plant, a copper plant, a coaxial cable plant, and hybrid versions/combinations of each. Because the principles of this invention may be applied to other physical infrastructures, these other physical infrastructures need not require the Digital Subscriber Line Access Multiplexer, the asynchronous transfer mode (ATM) switch, and the broadband gateway (shown, respectively, as reference numerals 58, 60, and 62 in FIGS. 2 and 3). These other physical infrastructures may require additional and/or alternative equipment, as those of ordinary skill in the art will recognize.

[0029] The principles of this invention, for example, could be applied to the coaxial cable industry. Whereas FIGS. 2 and 3 show the customer's premises 42 being served by *n* multiple twisted pairs, the customer's premises could be served by *n* multiple coaxial cables. These *n* multiple coaxial cables would be the multiple physical media providing media content to the customer's premises 42. When the customer's requested communications services exceed the available bandwidth of a primary coaxial cable serving a customer's premises, and/or a client communications device, then this invention physically and logically bonds *n* multiple, additional coaxial cables. The logically bonded *n* multiple, additional coaxial cables provide additional bandwidth when necessary. While there are many devices used within the coaxial cable infrastructure that could physically/logically bond the *n* multiple, additional coaxial cables, a cable modem termination system (CMTS) is one example.

[0030] The principles of this invention may also be applied to a fiber optic infrastructure. Because the cost of an all-fiber infrastructure is expensive, and because a fiber optic media can transmit/transport much more information/signals, one or more shared fiber optic lines could be

more economically feasible. A customer's premises could be served by *n* multiple fiber optic lines, and these fiber optic lines could also be shared by other customers. When one customer's requested communications services exceed the available bandwidth of a primary physical media (such as a DSL, a coaxial cable, and/or a fiber optic line), then this invention could physically and logically bond one or more fiber optic lines to the customer's session. The logically bonded fiber optic lines provide additional bandwidth when necessary. This fiber infrastructure, for example, might utilize an Optical Network Unit (ONU) to physically/logically bond one or more fiber optic lines to the customer's session.

[0031] The principles of this invention provide added benefits. Because the customer's premises are served by multiple physical media, these shared media provide redundancy. As the years pass, the physical and performance properties of the physical media may degrade. Because, however, the customer has access to multiple physical media, this invention provides greater statistical probabilities for successful transmissions of data signals. Because the customer, again, has access to multiple physical media, there is less of a chance that the customer will lose all communications service during storms and catastrophes. Should one of the physical mediums be severed or disabled, the other physical media provide redundant communications paths.

[0032] The principles of this invention provide still more benefits. Because this invention utilizes multiple physical mediums, each individual medium could be dedicated to a particular format. The primary physical medium, for example, might be dedicated to a specific service (such as standard Internet traffic) and/or a particular range of frequencies. An additional, shared medium might be reserved for higher bandwidth requirements (such as MPEG1/2/3/4 content) and/or higher frequency signals.

[0033] FIG. 5 is a flowchart illustrating a method of providing communications services. Signals are transmitted to a destination via a first physical medium (Block 110). If additional bandwidth is required (Block 112), a second physical medium is logically bonded to the first physical medium (Block 114), such that first physical medium and the second physical medium share the same session of information. Signals are then transmitted to the destination via the

second physical medium (Block 116). The second physical medium is dynamically shared amongst multiple destinations to provide additional bandwidth when required. Signals may be transmitted via a twisted pair, via a coaxial cable, via a fiber optic cable, and/or via hybrid combinations, such as i) a combination of a twisted pair and a coaxial cable, ii) a combination of a twisted pair and a fiber optic cable, and iii) a combination of a coaxial cable and a fiber optic cable (Block 118). If additional bandwidth is still required (Block 120), additional physical media can be logically bonded (Block 122). Each additional physical media is dynamically shared amongst the multiple destinations to provide additional bandwidth. Signals are then transmitted to the destination via the first physical medium and the second physical medium, thus sharing the same session of information (Block 124). When the signals are transmitted to the destination, the signals may be transmitted via twisted pair, coaxial cable, fiber optic cable, and hybrid combinations (Block 125).

[0034] FIG. 6 is a flowchart illustrating another method of providing communications services. Digital Subscriber Line (DSL) signals are transmitted to a destination via a first twisted pair (Block 126). If additional bandwidth is required (Block 128), a network device is instructed to logically bond a second twisted pair and the first twisted pair (Block 130), such that first twisted pair and the second twisted pair share the same session of information. Digital Subscriber Line signals are then transmitted to the destination via the second twisted pair (Block 132). The second twisted pair is shared amongst the destination and another destination, and the second twisted pair provides additional bandwidth when required. The second twisted pair may be physically bonded to the first twisted pair (Block 134), such that first twisted pair and the second twisted pair share the same session of information. If additional bandwidth is still required (Block 136), the network device is instructed to logically bond a third twisted pair to the destination (Block 138). The third twisted pair is shared amongst the destination and another destination, and the third twisted pair provides additional bandwidth when required. If additional bandwidth is still required (Block 140), the network device is instructed to logically bond *n* additional twisted pairs to the destination (Block 142). The *n* additional twisted pairs are shared amongst the destination and another destination, and the *n* additional twisted pairs provide

additional bandwidth when required. Digital Subscriber Line signals are then transmitted to the destination via the twisted pairs (Block 144).

[0035] FIG. 7 is a flowchart illustrating yet another method of providing communications services. A request for communications services is received from a client communications device (Block 142). A first physical medium and a second physical medium are logically bonded to the client communications device (Block 144). The second physical medium is dynamically shared amongst multiple client communications devices to provide additional bandwidth when required (Block 146). The communications services are then provided via the logically bonded first physical medium and the second physical medium (Block 148).

[0036] The Communications Module 20 may be physically embodied on or in a computer-readable medium. This computer-readable medium may include CD-ROM, DVD, tape, cassette, floppy disk, memory card, and large-capacity disk (such as IOMEGA®, ZIP®, JAZZ®, and other large-capacity memory products (IOMEGA®, ZIP®, and JAZZ® are registered trademarks of Iomega Corporation, 1821 W. Iomega Way, Roy, Utah 84067, 801.332.1000, www.iomega.com). This computer-readable medium, or media, could be distributed to end-users, licensees, and assignees. These types of computer-readable media, and other types not mention here but considered within the scope of the present invention, allow the Communications Module 20 to be easily disseminated. A computer program product for expanding bandwidth includes the Communications Module 20 stored on the computer-readable medium. The Communications Module receives a request for communications services from a communications device. The Communications Module compares a bitrate of the requested communications services to the bandwidth of a first physical medium serving the communications device. If the bitrate of the requested communications services exceeds the available bandwidth of the first physical medium, then the Communications Module instructs a network device to logically bond a second physical medium to the communications device. The logically bonded second physical medium provides additional bandwidth to the communications device.

[0037] The Communications Module 20 may also be physically embodied on or in any addressable (*e.g.*, HTTP, I.E.E.E. 802.11, Wireless Application Protocol (WAP)) wireless device capable of presenting an IP address. Examples could include a computer, a wireless personal digital assistant (PDA), an Internet Protocol mobile phone, or a wireless pager.

[0038] While the present invention has been described with respect to various features, aspects, and embodiments, those skilled and unskilled in the art will recognize the invention is not so limited. Other variations, modifications, and alternative embodiments may be made without departing from the spirit and scope of the present invention.